News from the Savannah River National Laboratory

October 2, 2002 For immediate release
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Research Paves the Way for Hydrogen-Based Energy

AIKEN, S.C. – A team led by the Savannah River Technology Center is embarking on a study that could ultimately lead to the extensive use of hydrogen-based energy sources as an alternative to expensive and polluting fossil energy. The research will examine the technical and economic issues associated with a new and innovative approach that could be used to produce hydrogen: using the heat from a nuclear power reactor to break water down into hydrogen and oxygen.

SRTC (the Savannah River Site's applied research and development laboratory) is working with its university partner, the University of South Carolina Department of Chemical Engineering, along with industrial partners General Atomics and Entergy Nuclear, and various consultants, on the three-year study. The U.S. Department of Energy's Nuclear Energy Research Initiative has provided $440,000 of funding for the first year of the study, and is expected to provide $1.35M over three years to support this research.

President Bush's National Energy Plan foresees that energy from hydrogen will have an increasing role in the national economy. Increasing our use of hydrogen and other alternative energy sources is necessary to reduce the nation's dependence on imported petroleum. Hydrogen also has many environmental advantages, including the reduction of nitrous oxides, sulfur and global warming gases.

SRTC Director Susan Wood explains the need for the research. "Before hydrogen can become a significant factor in the nation's energy supply," she says, "we must learn more about the practical issues of producing and supplying hydrogen on a large scale. This research is designed to answer some of the key questions that will allow the nation to decide how reactor-based hydrogen production might fit into the energy puzzle."

The study will look at the infrastructure needs, including the interface between the nuclear hydrogen production plant and the end-users. The study will seek to determine the preferred plant size, design and operating plans, the means of delivering the hydrogen to consumers, and the overall economics of hydrogen supply.

No actual facilities will be built as a part of this study, but the research will produce detailed descriptions of the characteristics of a commercial prototype system and an analysis of the economics of building such a system. The research will also provide information useful in developing the actual facilities and related infrastructure in the future.

The study will build on the existing design studies already funded by DOE and will have two phases. The first phase is an infrastructure analysis. This part of the study will be a comprehensive examination of reactor-based hydrogen production methods, and the related hydrogen infrastructure systems. This phase will produce the information needed to evaluate the technical feasibility and economic attractiveness of this approach to hydrogen production, and detailed information needed to build a prototype commercial system.

The second phase, the “Test Case Preconceptual Design” phase, will develop more specific, detailed results by analyzing the use of a hypothetical reactor at a specific site (SRS) to produce hydrogen for use by a specific customer (a local chemical plant). This part of the study will be particularly useful for determining the practicality of providing reactor-produced hydrogen for use by large industrial customers, such as oil refineries and chemical plants, during the nation’s transition to a more broad-reaching hydrogen-based economy.

SRTC, which is operated for DOE by the Westinghouse Savannah River Company, has over 50 years of nuclear and hydrogen expertise. The lab will lead and manage the study, and will be specifically responsible for defining the hydrogen storage, transmission and delivery systems.

Earlier this year, the laboratory signed an agreement with the University of South Carolina to jointly seek opportunities like this one to cooperate on research and development related to hydrogen energy. The university, which has considerable expertise in hydrogen and fuel cell technology, will lead the effort to develop an economic model to evaluate the various hydrogen infrastructure scenarios.

General Atomics will lead in the areas of nuclear reactor design and the thermochemical process. Entergy Nuclear, the nation’s second largest nuclear power plant operator, will validate the preliminary design and cost information, and provide the utility company perspective on the project.

WSRC-02-44